IMPROVING ENGINE AIN'T ROCKET SCIENCE

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ABSTRACT

This presentation deals with the efficiency of combustion engines. First it discusses inherited problems; handed down from one generation of combustion engines to another and later it explains wrong trends in current research that do not deal with the inherited systemic blunders, so uselessly burn taxpayers money while preserving the inherit faults. Then it proposes solutions to the inherit problems and short explanations how to redesign the engine with the emphasis on converting heat, currently wasted through cooling, to extra work that quadruples the efficiency of the proposed internal explosion engine referred to as a gun-engine.

Key words: exploding fuel; internal cooling; recompressing expanded exhaust, harmonic oscillator

INTRODUCTION

There have been several combustion engines on the market since Otto developed the first. The most important are four stroke gasoline and diesel engines. As the most popular, both contributed a lot to destruction of the Earth environment and climatic threats

Even though called modern and highly efficient, both are neither efficient nor modern. Quite the contrary, both are primitive and very inefficient machines that emit huge quantities of GHG (greenhouse gases) and deadly NOx toxins contributing the most to the climatic and environmental changes.

Both require fuel, air, compression and ignition to function. While the diesel is compression ignited, gasoline is spark ignited. They both

have an induction, compression, and power and exhaust evacuation stroke.

During the induction stroke the piston moves down in cylinder, the induction valve opens up and fills the cylinder with air; for diesel engines or with air and fuel mist; for gasoline engines. While the piston returns the induction valve closes up and compression stroke squeezes the air and injector injects fuel; for diesel engines or spark ignites the mixture for gasoline engines.

Combustion of fuel in a very small space causes huge temperature inducing high pressure that pushes the piston down. As the piston is connected to crankshaft, the resulting torque turns the crankshaft delivering power stroke.

At the end of power stroke, the exhaust valve opens up and the exhaust evacuation results. After the evacuation, the exhaust valve closes and induction valve opens up, so the next cycle commences.

The above described is all one needs to understand the operation of today's combustion engines. It is simple and obvious. Nobody questions the obviousness or simplicity, so combustion engines have not changed much for more than a century, preserving inefficient operation and releasing huge quantity of toxins and GHG that threaten our environment and induce climatic changes.

While current research is directed towards details, such as slowing down flame propagation or developing better valves or injectors, it is incapable to improve existing engines, despite huge financial support from governments. It is so because the faults are hidden in the design.

Dual fuel engine, resulting from the research, preserves inherited inefficiency and polluting capability, while advertised as highly efficient and modern. It seems that current trend in research is to improve rhetoric, but combustion engines.

The inefficiency in current engines causes huge economic problems, such as market disruption leading to wars. Ironically, wars are not needed, as it is only to improve the efficiency of combustion engines to eliminate imports of oil. This presentation shows how to quadruple the efficiency of combustion engines and the proposed solution is surprisingly simple, easy and inexpensive.

Energy is always preserved and cannot be consumed. All we can do is to convert energy from one form to another. There are mainly two forms of energy, one is a useful form that we know how to use and the other is useless that we don't.

The useful forms of energy energize our gadgetry. We still use pure mechanical forms of energy, such as wind mills or sails, but the XX century commenced a new era of combustion engine that made us masters of converting useful forms of energy into useless.

Combustion engine converts potential chemical energy in fuels into mechanical energy, but in fact it transforms all the energy into the environment as heat. Unfortunately we have not yet developed such a technology that would allow us to utilize the energy stored in the environment. The author believes that directing effort to minimize the above transformation could lead to a better engine.

INHERITED CAUSES OF INEFFICIENCY

The most important inherit fault in current engines is heat waste trough cooling system that plays an important role in preserving the inefficiency. This presentation deals with this problem.

The second, yet not less important inherit cause of inefficiency is not complete expand of exhaust, so the release of hot exhaust that posses lot of potential is a waste of that potential.

While huge pressure generated by combustion meets alignment of crank with the centerline of cylinder it also represents inherit cause of inefficiency, as torque at this very moment, despite the highest potential, is not produced and the highest potential is lost.

Another inherit fault in current engine is that the engine could not withstands explosions of fuel.

Fuels, especially gaseous, are destine to explode, yet exploding fuel has devastating effects on current engines, thus researchers have put a lot of effort into slowing down flames propagation within the cylinder to prevent

explosions, yet have not come out with a proper solution for hydrogen that is very explosive

Exploding fuel in current engine causes devastation to the engine as huge pressure, more than three times, which resulted from combustion, calls for quadrupling the strength of crank and related parts. In addition, the piston crown directly exposed to explosion calls for super-cooling as the temperature of explosion triples that caused by combustion. As the piston is the worst cooled part, its crown melts within minutes of operation.

Yet, from the efficiency point of view, the explosion is much better than combustion. It is better as it has higher limitation defining the efficiency of ideal engine referred to as Carnot heat engine and that calls for directing research effort towards speeding up and not slowing down the flames propagation within the cylinder.

SOLUTION TO INHERIT PROBLEMS IN ENGINES

The author of this presentation proposes to eliminate all the mentioned inherit causes of inefficiency in current engines and insists that quadrupling the efficiency is simple, easy and inexpensive.

The author asked and answered the question, “Is it possible to develop such a cooling in which a cool preserves heat?” and found out that it is trivial, so is the elimination of radiator, (the major cause of inefficiency in current engines) thus he proposes to replace current cooling, based on coolant jacket around cylinder and radiator, with internal cooling that preserves heat.

The cooling is based on direct injections of water into explosion chamber, so steaming would cool engine internally and the heat would be preserved in the resulting steam and not wasted. The author also proposes the ratio of water to fuel as 8:1 for gasoline.

In order to limit the volume of water tank, the author also proposes to use condensation as means to separate water from exhaust, so water could be reused for internal cooling and pure exhaust released.

In addition to better cooling, the direct injections of water into the explosion chamber would also assure that piston's crown is the best-cooled part of the engine, thus explosions of fuel would not melt it.

In order to reduce stress in crank and related parts, the author proposes to replace the cylinder head of current engine with a harmonic oscillator, the output of which produces power input to the work-piston of the mentioned engine.

Indeed the harmonic oscillator shields the piston and in addition, it delays building the pressure over work-piston, so it is possible, through proper selection of the bulk of its oscillating mass, to cause the meeting of the highest force; acting on piston, with longest distance of crank from the centerline of cylinder, (crank at 90 degree) thus amplifying torque 5 to 9 times, without any increase of fuel consumption.

The proposed solution is very simple and inexpensive. It also allows using plastics more widely for parts, (only those parts exposed to explosions of fuel need to be made out of metal) thus lowering bulk and costs of production of the proposed gun-engine, the efficiency of which would quadruple that of current engines saving 80% of fuels and cutting 80% of greenhouse gases emission, while totally eliminating synthesis of NOx type of pollutants.

This proposed solution is also an alternative to a high power long stroke slow speed marine engines that are extremely bulky and expensive, yet not as efficient as the proposed engine.

In order to provide explosive mixture of fuel vapor with air, the author proposes using heat in exhaust to heating a large surface soaked with fuel and the airflow that improves vaporization and premixes vapor with air. The mentioned surface would result from injecting fuel onto metal-wool (thin metal wires resembling loose wool) filling a chamber heated with a flow of exhaust surrounding the chamber. The airflow through the metal wool would improve vaporization of fuel soaking the wool and an electric heater wrapped into the mentioned wool could assure proper operation during start-ups. The metal wool conducts heat well, so fuel wetting the plurality of little surfaces of wires would boil fast.

The initiation of explosions could be by electric spark or infrared laser; for very high-octane fuels such as hydrogen or natural gas, or by compression heat induced with an over-compression; never used before, to assure explosion initiation at, or just prior to, the alignments of crank with the centerline of cylinder.

The words “over-compression” should be understood as such a compression that is much higher than that related to octane number of the used fuel.

As the use of spark plagues for explosions is not very reliable, since high temperature of explosion quickly deteriorates the insulation between electrodes, the proposed internal cooling also prevents that, so the author advice using the spark plague or laser, as both could lasts longer than in current engine and both are reliable.

As the resulting engine is destine to explode fuels, there is no need for advancing the explosion initiation and the explosion should be initiated when crank is aligned with the centerline of the cylinder as that assures the optimal conversion of energy, released by explosion, into kinetic energy stored in a moving mass of the harmonic oscillator, (highest possible pressure during explosion due to minimization of space containing the explosion is in TDC). The conversion is similar to that in guns, thus the name “gun-engine”.

The resulted engine produces torque independent from speed, thus no need for energy consuming reduction gears or transmission.

In addition to all the above, the engine could be energized with many fuels without any adjustments and that would give the owner opportunity to select the most inexpensive fuel on the market.

CONVERSION OF HEAT TO EXTRA WORK IN THE PROPOSED GUN-ENGINE (patent pending)

While the proposed engine is comprised of a current engine, the cylinder head of which is replaced with a harmonic oscillator, it

utilizes multiple conversion of energy from pneumatic, stored in pressurized exhausts, into kinetic stored in a moving mass that is then converted into pneumatic (loaded spring) stored in an air cushion acting on piston.

Exploding fuel, over the mentioned mass, cannot move mass instantly due to inertia, so the mass accelerates squeezing the air cushion, the static pressure of which defines compression ratio of the proposed engine.

While injection of water into explosion chamber prior to exploding fuel causes sprinkling and rapid steaming, during and after the explosion, the steaming cools and the cool preserves heat, taken out of the exhaust and internal parts, in the resulting steam.

Since the acceleration moves the mass, the exhaust saturated with overheated steam expands. The expansion cools the mixture.

The movement of mass squeezes the air cushion causing the pressure in cushion to increase. The increase is such that at certain moment the whole kinetic energy in mass is transferred into the air cushion so the mass stops and bounces back, oscillating.

Then the energy stored in the air cushion, at that moment, is equal to the energy released by explosion, lessen the energy converted to work as well as the energy to overcome friction and indeed some negligible heat absorbed by internal parts.

The bouncing back recompresses the exhaust with steam, but the recompressed have less energy, so the temperature drops down.

After certain amount of recompressions/expansions, the temperature drop is reaching the dew point, so a fog mixed with exhaust results. The fog is evenly distributed within the whole volume of exhaust and disappears during recompression due to heating up by compression heat, which indicates that the heat, previously wasted through cooling has already been partially converted to extra work.

Further recompressions and expansions convert previously wasted potential, which used to be released with incompletely expanded exhaust, to extra work.

The existence of fog after several recompressions indicates that the whole heat generated by explosion is converted to work and that calls for a release of the exhaust.

Indeed the above is valid during resonant, when the angular speed of work producing piston matches the angular speed of harmonic oscillator and the phase difference between them is 180 degree, so the movement of piston opposes that of the harmonic oscillator. This certainly delivers a multiple power stroke resulted from a single explosion of fuel, it also boosts the efficiency above any expectations.

To assure proper operation of the proposed engine the valves should not be manipulated in current way based on camshaft. Instead these should be manipulated independently from positioning of the crank by electromagnetic or hydraulic or pneumatic actuations.

To assure proper timing the controller of the engine should use timing based on optical disk, similar to that in robotics, as this would assure utmost precision of control.

MATHEMATICAL MODEL OF PROPOSED GUN-ENGINE

Since the proposed gun-engine comprises prior art engine the cylinder head of which is replaced with a harmonic oscillator its operation differs from that of current engine and that also impacts the mathematical model of energy conversion, since harmonically oscillating pressure output is imposed on adiabatic expansion.

(1) $W = (0.36 \bullet P_{\max} \bullet e^{-\beta t} + P_{stat}) \bullet V$ Wherein:

W – Work

$P_{\max}$ - Pressure induced by explosion of fuel;

P_{stat} - Static pressure in air cushion;

β - Damping, depending from friction and work extraction;

V – Volume displaced by work piston

t – time (0< t >duration of power stroke)

Attention!

- P_{max} is about 15 times that of the average pressure in current engine

PROPOSED NEW TRENDS IN RESEARCHING ENGINES

The author of this presentation believes that his proposed engine should commence a better direction of researching engines. He also insists that the present direction should be abolished or even forbidden as useless and replaced with directing research effort towards speeding up energy release by exploding fuels.

Exploiting harmonic oscillations or perhaps multiple harmonic oscillators enforced by a single; or even multiple explosions that interact with each other, that drive the piston to achieve plurality of resonating frequencies; in the same way as radio is tuned to a desired station.

The author thinks that plurality of explosions “sandwiched” with plurality of resonating masses could lead to slow speed high power engines that are ultra-light, (up to 1000 HP power could result from a single 100mm (4”) cylinder) which would eliminate need for extremely bulky and expensive long stroke slow speed marine monsters. This concept could deliver a 200,000, HP at 100 rpm) engine for a lower price than current 10,000 HP long stroke marine engine.

Another important direction could be to investigate possibility of exploding solid fuels, the powder of which while mixed in proper proportion with air explodes.

There have been many accidents, in the past that involved explosions of wheat flour or coal dust or any other dusts in grain mills or coal storage facilities. Why not to investigate possibility to utilize these to energize engines? It would certainly help farmers to develop a method that could utilize straw or hey dust to energize tractors or other agriculture equipment. It would also help individual loggers to develop an engine fueled with sawdust. Wouldn’t it?

A pulverized coal could be also an option, especially because the era of oil soon comes to its end. There are hundreds, perhaps thousands of different ways to convert energy from solid, liquid or gaseous fuels, (not yet discovered) so why mindlessly waste resources and continue with current trends that preserve all inherit faults and the inefficiency? We do not need to be the masters of waste. Do we?